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EXAMINER	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 112803

Application Number: 09/168,770
Filing Date: October 08, 1998
Appellant(s): SHAH ET AL.

Charles W. Stewart and Leonard P. Miller
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 26 August 2003.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The brief does not include a statement of the status of the claims. A correct statement of the status of the claims is as follows:

This appeal involves claim(s) 1-7 and 13-24.

Claim(s) 8-12 are withdrawn from consideration as not directed to the elected invention.

Claim(s) 1 and 18 have been amended subsequent to the final rejection.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 1-7, 13-16 and 18-23 stand or fall together and that claims 17 and 24 do not stand of all with the other claims, and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

EP 0 450 872	Ruhl	10-1991
US 5,255,742	Mikus	10-1993
US 4,692,306	Minet et al.	9-1987

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Rejection of Claims 1-7, 13-16 and 18-23 Under 35 U.S.C. 103(a)

Claim(s) 1-7, 13-16 and 18-23 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Ruhl (EP 0 450 872) in view of Mikus (USP 5,255,742).

Regarding claim(s) 1 and 18, Ruhl, in Fig. 1, disclose(s) a process heater comprising:

- an oxidation chamber (30) having an inlet (40) for oxidant, an outlet (54) for combustion products and a flow path (Fig. 1) between the inlet (40) and the outlet (54);
- a fuel conduit (34) for transporting a fuel the oxidation chamber (30), the fuel conduit containing at least one fuel nozzle (Fig. 1) within the oxidation chamber (30), said at least one nozzle providing fluid communication from within the fuel conduit (34) to the oxidation chamber (30);
- a preheater in communication with the oxidation chamber inlet (P5/L41-46); and
- a process chamber (20) in a heat exchange relationship to the oxidation chamber (30).

While Ruhl shows embodiments of his heater that operate without a flame (see Fig. 4), such operation is not disclosed with respect to Fig. 1.

Mikus, in Fig. 3, teaches a process heater comprising:

- an oxidation chamber (10) having an inlet for oxidant, an outlet for combustion products and a flow path between the inlet and the outlet (Fig. 3);
- a fuel conduit (12) for transporting a fuel to the oxidation chamber (10), the fuel conduit containing a plurality of fuel nozzles (13) along the length of the oxidation chamber (10), each nozzle (13) providing fluid communication from within the fuel conduit (12) to the oxidation chamber (10), the fuel nozzles (13) being spaced so that the fuel is added to the oxidation chamber (10) at a rate that no flame results when the fuel is mixed with the oxidant flowing through the flow path in the oxidation chamber; and
- a preheater in communication with the oxidation chamber inlet, the preheater capable of increasing, at least, the temperature of the oxidant to a temperature at which when said oxidant and the fuel are mixed in said oxidation chamber, the temperature of said mixture of fuel and oxidant exceeds the autoignition temperature of said mixture (C3/L25-30).

In said process heater preheating at least the air stream and then mixing the fuel gas into the combustion air in relatively small increments will result in the flameless combustion (C4/27-40). The absence of flame eliminates the flame as a radiant heat source and results in more even temperature distribution throughout the length of the burner (abstract). Further it eliminates the hot spots within the burner and structures surrounding the burner, which originate from the radiant heat transfer from the luminous portion of the flame. Said process heater not only optimizes the process operation but it is also less expensive than a process heater operating with flames because of less expensive materials of construction (C2/L4-12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace the heater in the apparatus of Ruhl with the heater of Mikus for the purpose of

providing more even temperature distribution throughout the length of the burner and lowering the costs of said apparatus.

While Mikus does not explicitly disclose said nozzles being distributed along substantially the entire length of the oxidation chamber, the reference discloses that said nozzles are distributed along the entire area where the process is occurring and where the heat transfer is desired (Fig. 3). In view of this teaching, and in view of general knowledge available to one of ordinary skill in the art, that heat transfer to a process can be optimized by placing a heater in a location where heat is desired, it would have been obvious to one of ordinary skill in the art at the time the invention was made to place said nozzles in any location where heat transfer to process in the process chamber is required, said locations including nozzles along substantially the entire length of the oxidation chamber, for the purpose of optimizing heat transfer to the process chamber. Further, the examiner notes that it would have been obvious to one having ordinary skill in the art at the time the invention was made to add an additional nozzles to the fuel conduit, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

Regarding claim(s) 2-4, Ruhl in view of Mikus disclose(s) all of the claim limitations as set forth above. Additionally Mikus discloses the heater further comprising:

- a coke inhibitor injection system in fluid communication with the fuel conduit wherein an amount of coke inhibitor supplied can be effective to inhibit coke formation at fuel conduit operating temperatures (C6/L25-35); wherein
- the fuel conduit is a tubular conduit essentially centrally located within the oxidation reaction chamber (Fig. 3); and
- oxidation reaction chamber is essentially centrally located within the process chamber (Fig. 3).

Regarding claim(s) 5-6, 13, 16, 19-21 and 23, Ruhl in view of Mikus disclose(s) all of the claim limitations as set forth above. Additionally Ruhl discloses a heater further comprising:

- the process chamber is a pyrolysis chamber for thermal cracking of hydrocarbons in production of olefins (P3/L3-21);
- the process chamber contains a catalyst and is used for steam methane reforming (P3/L3-21);
- the process chamber is used for an endothermic chemical reaction (P3/L3-210),
- wherein the endothermic chemical reaction is conducted in a single stage and heat is provided to the process chamber by the oxidation chamber at a controlled temperature profile (Fig. 4, P3/L3-210 and P5/L51-57).

Regarding claim(s)) 1-7, 13-16 and 18-23 it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Rejection of Claims 17 and 24 Under 35 U.S.C. 103(a)

Claim(s) 17 and 24 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Ruhl (EP 0 450 872) in view of Mikus (USP 5,255,742) and further in view of Minet et al. (USP 4,692,306).

Regarding claim 17 and 24, Ruhl in view of Mikus disclose all of the claim limitations as set forth above, additionally the reference discloses that the oxidant can be preheated by any means known to one of ordinary skilled artisan (P5/L41-46), but the reference does not disclose that said oxidant is preheated by the effluent of the process chamber.

Minet et al. teaches a reaction chamber, wherein the reactants are preheated by the effluent of said reaction chamber (Fig. 1 and C5/L60-68).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the hot effluent of the process chamber of Ruhl to preheat the oxidant, as taught by Minet et al., for the purpose of optimizing the process operation by using heat which is available in the process for the required oxidant preheating. In this way the operation cost can be lowered because no additional source of heat is needed to preheat said oxidant.

Regarding claim(s)) 17 and 24 it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

(11) Response to Arguments

Response to Arguments Regarding

Rejection of Claims 1-7, 13-16 and 18-23 Under 35 U.S.C. 103(a)

The appellant argues that there is no motivation to combine the references of Ruhl and Mikus, because the motivation cited by the examiner (that it is desired to replace burners using flame with a flameless burners because the absence of flame eliminates the flame as a radiant heat source and results in more even temperature distribution throughout the length of the burner (Mikus, abstract), and further as it eliminates the hot spots within the burner and structures surrounding the burner originating from the radiant heat transfer from the luminous portion of the flame; said flameless process heater not only optimizes the process operation but it is also less expensive than a process heater operating with flames because of less expensive materials of construction (Mikus, C2/L4-12)) is based on erroneous assumption that even or uniform temperatures throughout the process chamber of Ruhl are beneficial. The appellant argues that Ruhl does not desire uniform temperature because the feature of Ruhl's apparatus is that it allows

use of relatively low temperature seals. Further, the appellant argues that if a heater of Mikus was used in the apparatus of Ruhl, it is likely that the temperatures in the upper and lower portions would be too high to use the low temperature seals, and that necessary redesign of apparatus of Ruhl including use of high temperature seals could actually increase the cost of said apparatus.

This is not found persuasive. While the main thrust of appellant's arguments relies on desirability of using "relatively low temperature" materials, either as seals (Fig. 1) or plugs (Fig. 4), the appellant arguments are relying merely on relative terms, such as "lower" or "higher" temperature, and not on objective evidence, such as actual operating temperatures in the apparatus of Ruhl or the operating temperature ranges for the seals used in said apparatus. In this regard, mere arguments and conclusory statements of counsel, which are unsupported by factual evidence, are entitled to little probative value. *In re Linder*, 457 F.2d 506, 508-09, 173 USPQ 356, 358 (CCPA 1972); *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984); *In re Wood*, 582 F.2d 638, 642, 199 USPQ 137, 140 (CCPA 1978).

The examiner would like to point out that neither the reference of Ruhl nor the invention recited in claims 1 or 18 are limited to any specific processes or temperature ranges. While some exemplary processes are disclosed in Ruhl, the reference discloses an invention relating to an "apparatus used in conducting endothermic reactions" (Ruhl, P3/L3). Further, while reference does refer to the seals or plugs used in various embodiments as "relatively low temperature", it does not explicitly disclose any operating temperature ranges for said seals or plugs. But what Ruhl does disclose is an example of sealing material that can be used in said seals or plugs (a graphite foil spiral wrapped annular cylinder seal (such as Grafoil brand foil from Union Carbide)), see Ruhl, P4/L39-42. The examiner would like to point out that functional temperature range for typical Grafoil products from Union Carbide is from -400°F to 5400°F (-200°C to

3000°C), for neutral or reducing atmospheres. While the temperature ranges for oxidizing atmospheres are somewhat lower, they can be increased by ensuring that the Grafoil does not come in direct contact with the oxidizing fluid.

Since exemplary endothermic reactions for which the apparatus of Ruhl can be used are operated at temperatures significantly lower than the maximum operating limit for Grafoil seals (e.g. methane steam reforming which is carried out at about 1500°F (see Ruhl, P3/L6-26)), the presence of temperatures sufficient for said exemplary reaction to occur in upper and lower regions of the apparatus of Ruhl, in the near vicinity of said seals, would not have negative effect on said seals. Therefore, as set forth above and in the final Office action, it is examiner's position that replacing the process heater of Ruhl with the process heater of Mikus would be obvious to one of ordinary skill in the art. The motivation to do so is found in the references themselves, which state that it is desired to replace burners using flame with a flameless burners because the absence of flame eliminates the flame as a radiant heat source and results in more even temperature distribution throughout the length of the burner and further it eliminates hot spots within the burner and structures surrounding the burner originating from the radiant heat transfer from the luminous portion of the flame (see Mikus, abstract and C2/L4-12). Additional motivation can be found in the knowledge generally available to one of ordinary skill in the art. Said artisan knows that, in any processes using a catalyst bed, a uniform temperatures through out said catalyst bed are optimal for the process operation. Elimination of hot and cooler spots throughout the catalyst bed will, for example, prolong catalyst life and optimize reaction rates throughout the entire catalyst bed.

Additionally, even if Ruhl did, arguendo, desire non-uniform temperature throughout the length of the oxidation chamber, the apparatus of Ruhl still would benefit from use of a flameless

burner in a oxidation zone, since it would eliminate the hot spots within the burner and structures surrounding the burner, said hot spots originating from the radiant heat transfer from the luminous portion of the flame, since elimination of said hot spots would allow for construction of said burner from less expensive materials, as taught by Mikus, C2/L4-12. In fact, Ruhl, in Fig. 4, discloses an embodiment wherein burner located in an oxidation zone comprises a fuel conduit comprising a plurality of fuel nozzles and does not have a flame.

Further, the appellant argues that apparatus of Ruhl requires higher heat flux, to support endothermic reactions occurring within said apparatus, than a heat flux that could be produced by the flameless burner of Mikus. Additionally, the appellant states that said arguments are supported by an affidavit of Dr. Mikus filed on 19 August 2002.

The examiner would like to reiterate that, contrary to appellant's statement, she has given an appropriate weight to said affidavit (and to appellant's arguments), but found it to be not persuasive. The statements in the affidavit that the flameless burner of the Mikus' reference provided only about 375 Watts per foot of length, while endothermic chemical processes could require a profile of heat flux varying with distance from 3,500 to 7,00 Watts per foot are not sufficient to overcame prima facie case, as set forth by the examiner in the final Office action.

It was known to one of ordinary skill in the art at the time of the invention that combustion temperature and a heat flux of a burner can be affected by a multitude of variables, for example flow rates of gases being burned, composition of fuel being burned and/or oxidant used in the burner, the tube design (materials of construction, length and diameter), heat transfer properties of material being heated, number of heaters, etc. In fact, the reference of Ruhl teaches that the apparatus can incorporate as many heater tubes as necessary to provide heat required by the process (see Ruhl, P5/L36-40) and that temperature of combustion gases, and inherently heat flux

of the heater, can be varied by adjusting the fuel composition and flow rates of fuel and air (see Ruhl, P7/L4-7). Additionally, Mikus teaches that the heat transferred from disclosed process heater can be increased significantly by increasing the diameter of the heater (Mikus, C5/L15-25).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the heater in the apparatus of Ruhl with the heater of Mikus for the purpose of providing more even temperature distribution throughout the length of the burner and lowering the costs of said apparatus, as set forth above. Additionally said skilled artisan would modify, among others, fuel composition and flow rates of fuel and air and/or the number of heaters in the apparatus of Ruhl (as taught by Ruhl), or the burner diameter (as taught by Mikus), in order to obtain temperatures and heat fluxes necessary to complete endothermic reactions run in said apparatus.

Further, the examiner notes that a reasonable expectation of success for this proposed use of flameless heater of Mikus in the apparatus of Ruhl is supported by the fact that Ruhl, in Fig. 4, discloses an embodiment wherein burner located in an oxidation zone comprises at least one fuel conduit comprising a plurality of fuel nozzles and does not have a flame.

Additionally the examiner would like to point out that actual heat fluxes or temperatures or any specific processes are not positively recited in claims 1 or 18. The recitations of a process heater "for high temperature reactions" or that "process chamber is in a heat exchange relationship with the oxidation chamber whereby a controllable heat flux is provided to the process chamber at a sufficiently high rate to complete the process being conducted therein" do not confer patentability to an apparatus claim, because terms such as "high temperature" and "sufficiently high rate" are relative terms relating to a manner of operating recited apparatus and they do not impart any further structural limitations on said apparatus.

Appellant's arguments that there are significant differences in the combustion tubes of Ruhl and Mikus, such as length and diameter of fuel and combustion air conduits, and, therefore, that a great deal more than merely increasing the number of heat injector tubes would be involved to try to adapt the heat injectors of Mikus to the reaction apparatus of Ruhl, are not found persuasive.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the size of combustion tubes of Mikus to fit in the apparatus of Ruhl, said modification including changes in, among others, the length and diameter of fuel and combustion air conduits, since such modifications would have involved a mere change in a size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955). Additionally, where the only difference between the prior art and the claims is a recitation of relative dimensions of the claimed device, and the device having the claimed dimensions would not perform differently than the prior art device, the claimed device is not patentably distinct from the prior art device, *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984).

Appellant's arguments that burner of Mikus does not satisfy the claimed structural limitations because it does not have "a process chamber" or "a plurality of nozzles along substantially the entire length of the oxidation chamber" are not found persuasive.

The examiner notes that while Mikus was not relied upon to disclose a process chamber (said process chamber being disclosed by Ruhl, as set forth above) it does, in fact disclose a process heater. In view of the definition of the word process being, among others, "a series of

actions, changes, or functions bringing about a result"[1], the heater of Mikus reads on the process heater recited in the instant claims.

Regarding the recitation of "a plurality of nozzles along substantially the entire length of the oxidation chamber" the examiner notes that an ordinary artisan looking at Fig. 3 of Mikus would differentiate between the parts of fuel and oxidant conduits leading to formation to be heated and parts of said conduits within said formation. Said ordinary artisan would not define the oxidation chamber to stretch throughout the entire length of said conduits, but rather to be confined only to the parts of said conduits within the formation to be heated. The remaining parts of said conduits would be defined merely as feed conduits to said oxidation chamber. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made that Fig. 3 of Mikus does, in fact show "a plurality of nozzles along substantially the entire length of the oxidation chamber".

Response to Arguments Regarding Rejection of Claims 17 and 24 Under 35 U.S.C. 103(a)

The appellant argues that neither Ruhl nor Mikus nor Minet et al. teach preheating of the combustion air stream by the effluent of the process chamber. This is not found persuasive. Both, Ruhl and Mikus teach that it is desired to preheat the combustion air (see Ruhl, P5/L41-46 and Mikus, C3/L25-30 and C4/L27-41). While the references do not explicitly teach using heat available from the process effluent as source of heat used to preheat said combustion air, the principle that one can lower operating costs of a system by using heat which is already available in said system is so well known that no reference should be necessary. This being said, the examiner

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has in fact cited a reference (Minet et al.) that teaches that heat of effluent of a process chamber is being used to preheat a feed stream for said process chamber (see Minet et al., Fig. 1 and C5/L60-68). In view of this teaching, and in view disclosure of Ruhl and Mikus that it is desired to preheat the combustion air, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the hot effluent of the process chamber of Ruhl to preheat the combustion air for the purpose of optimizing the process operation by using heat which is available in the process for the required preheating of combustion air. In this way the operation cost can be lowered because no additional source of heat is needed to preheat said combustion air.

(11) Conclusion

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Basia Ridley
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November 30, 2003

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